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UTILITY PATENT APPLICATION TRANSMITTAL UNDER 37 C.F.R. §1.53(b)

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Transmitted herewith for filing is the patent application of

INVENTOR OR APPLICATION IDENTIFIER: Seong Whan KIM and Cheol Kyun HEO

FOR: METHOD FOR TRANSMITTING AND RECEIVING MESSAGE OF SHORT MESSAGE BROADCASTING SERVICES IN TELECOMMUNICATION SYSTEM

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Enclosed are:

1. ☒ 16 pages of specification, claims, abstract
 2. ☒ 3 sheets of FORMAL drawing.
 3. ☒ 2 pages of newly executed Declaration & Power of Attorney (original).
 4. ☒ Priority Claimed to Korean Appln. No. 1999/37479, whose entire disclosure is incorporated herein by reference.
 5. ☐ Small Entity Statement.
 6. ☐ Information Disclosure Statement, Form PTO-1449 and reference.
 10. ☒ Authorization under 37 C.F.R. §1.136(a)(3).
 11. ☐ Other:
7. ☒ Assignment Papers for LG Information & Communications, Ltd.
 (cover sheet, assignment & assignment fee).
 8. ☐ Certified copy of _____.
 9. ☒ Two (2) return postcards.
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☒ Prepaid Postcard-Stamped Filing Date & Returned with Unofficial Serial Number.

CLAIMS AS FILED					
For	No. Filed		No. Extra	Rate	Fee
Total Claims	19	- 20	0	X \$18.00	\$0.00
Indep. Claims	2	- 3	0	X \$78.00	\$0.00
Multiple Dependent Claims (If applicable)				X \$260.00	\$0.00
				BASIC FEE	\$690.00
				TOTAL FILING FEE	\$690.00

- ☐ This is a Continuation-in-part (CIP) of prior application No: _____ filed _____. Incorporation By Reference-The entire disclosure of the prior application is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
☐ Amend the specification by inserting before the first line the sentence:
 --This application is a continuation-in-part of Application Serial No. _____ filed _____.--
☒ A check in the amount of \$690.00 (Check #9326) is attached.
☐ Please charge my Deposit Account No. 16-0607 in the amount of \$____. A duplicate copy of this sheet is enclosed.
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FLESHNER & KIM, LLP

 Daniel Y.J. Kim
 Registration No. 36,186

Correspondence Address Below:

P.O. Box 221200

Chantilly, VA 20153-1200

(703) 502-9440 DYK/kam

Date: September 5, 2000

METHOD FOR TRANSMITTING AND RECEIVING MESSAGE OF SHORT MESSAGE BROADCASTING SERVICES IN TELECOMMUNICATION SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to mobile communication services, and more particularly to a method for transmitting and receiving short message broadcasting services in a code division multiple access communication system.

Description of the Related Art

Short Message Service (SMS) procedure for a code division multiple access (CDMA) system includes transmitting broadcast messages from a Short Message Service Center (SMSC) to mobile stations through a base station (BS), and receiving the broadcast messages transmitted from the BS at a mobile station MS. Generally, the BS transmits broadcast messages to a MS through two forward channels, namely a paging channel and a broadcast channel. A MS receiving the SMS chooses the messages from among the transmitted broadcast messages.

The BS may transmit broadcast messages using one of various transmitting methods such as a multi-slot broadcast transmission, a multi-slot broadcast paging or a periodic broadcast paging. Of these methods, the multi-slot broadcast message transmission is the simplest, causing the least amount of delay in transmission, and is used regardless of whether a periodic broadcast paging transmission is available. In the multi-slot broadcast message transmission, broadcast messages are transmitted from a BS to MSs within the service region of the BS through all slots of a control channel. However, because the broadcast messages are transmitted using all slots of the control channel, an overload of the control channel may occur, thereby impeding transmission of messages

other than the broadcast messages.

On the other hand, the multi-slot broadcast paging is used when the periodic broadcast paging is unavailable. In this method, a general paging message of a relatively small size, which indicates a forthcoming transmission, is first transmitted to MSs through all slots of the control channel before transmitting a broadcast message of a large size.

However, the periodic broadcast paging is a more efficient method than the multi-slot broadcast transmission as well as the multi-slot broadcast paging methods. In the periodic broadcast paging, a BS gives a notice to MSs of the periodic transmission of broadcast messages before periodically transmitting the broadcast messages. Particularly, a BS first transmits a general page message including a broadcast page information in every first slot of a broadcast cycle. Thereafter, a MS can determine the type and time of the message transmission based on the broadcast page and receive broadcast messages in consecutive slots of the broadcast cycle.

A detailed explanation of the periodic broadcast paging, which is most commonly used by communication systems including the CDMA, will follow. However, a description of a common control channel will first be provided. The common control channel is a channel used when a BS transmits an overhead information required for the operation of a MS as well as a general paging message for paging a MS.

Generally, the common control channel is a paging channel or a broadcast channel, but for purposes of explanation, the operation of the common control channel will be discussed with respect to the paging channel. However, such operations can also be performed through a broadcast channel.

Fig. 1 shows a general configuration of a paging channel for the SMS. As shown in Fig. 1, a BS loads and transmits broadcast messages in a slot of 80ms, where each slot recurs in every 2048

slot of the paging channel with respect to the system time. The slot (SLOT_NUM) at which a broadcast message is transmitted can be calculated by Equation 1 below, where 't' represent a system time for each frame of the paging channel.

$$[1] \quad \text{SLOT_NUM} = \lfloor t/4 \rfloor \bmod 2048$$

A MS remains in a non-active state and becomes active to receive broadcast messages transmitted in the 80ms slot of the paging channel. Upon receipt of the messages, the MS returns back to the non-active or idle state. The periodic broadcast paging method in the related art will next be discussed with reference to Fig. 2.

Referring to Fig. 2, a BS transmits broadcast page information in every first slot of a broadcast cycle and transmits broadcast messages in subsequent slots of the broadcast cycle to MSs. A MS which is configured to receive SMS broadcast message then receives the broadcast messages based on broadcast page(s) by periodically monitoring every first slot of the broadcast cycle to receive the broadcast page information. Here, the maximum interval of the broadcast cycle (M) can be calculated by Equation 2, where 'i' represents a maximum slot cycle index (MAX_SLOT_CYCLE_INDEX) field value of a system parameter message transmitted to a MS through the paging channel..

$$[2] \quad M = 2^i \times 16, 0 \leq i \leq 7$$

Accordingly, based upon the broadcast cycle M, a BS transmits broadcast page information

through a first slot of a broadcast cycle, where the slot number is calculated by Equation 3 below. In other words, the BS transmits Broadcast Pages 1, 2, and 3 through the first slot a broadcast cycle, which is indicated as '0' in the paging channel shown in Fig. 2.

$$[3] \quad \lfloor t/4 \rfloor \bmod M = 0$$

Each broadcast page transmitted through the first slot as described above, includes at least one broadcast address (BC_ADDR), where each BC_ADDR includes information regarding a broadcast message. As shown in Fig. 2, the first broadcast page would include two broadcast addresses corresponding to the first broadcast message in slots 3 and 4, the second broadcast page would include a broadcast address corresponding to the second broadcast message in slot 6, and the third broadcast page would include three broadcast addresses corresponding to the third broadcast message in slots 9~11. Thus, a BS periodically transmits broadcast page(s) in the first slot and broadcast messages in subsequent slots of the broadcast cycle, after notifying MSs of its broadcast cycle through a system parameter message of the paging channel.

Here, a broadcast index field (BCAST_INDEX) of an expanded system parameter message is used. Namely, a value of BCAST_INDEX is set as 'i, (1 ≤ i ≤ 7)' when the BS is providing a SMS and '0' otherwise. If the value of the BCAST_INDEX is set as 'i,' the broadcast cycle in which the broadcast message is transmitted can be calculated using Equation 4.

$$[4] \quad B = 2^i \times 16, 1 \leq i \leq 7$$

After the value of B is obtained by Equation 4, the broadcast message is transmitted by a broadcast cycle of (B+3) and the first slot of the broadcast cycle can be calculated by Equation 5.

$$[5] \quad \lfloor t/4 \rfloor \bmod M(B+3) = 0$$

When broadcast messages are periodically transmitted through a paging channel, a MS must also periodically monitor the assigned paging channel. Thus, a MS receives the transmitted broadcast page(s) from the BS through the first slot of the broadcast cycle and if several broadcast addresses (BC_ADDR) are included in the broadcast page(s), the MS checks the subsequent slots to receive the necessary broadcast message.

In the CDMA system of the related art for the SMS, the broadcast index field BCAST_INDEX of the expanded system parameter message is used only to set the state of a broadcast cycle and thus the SMS on or off. As a result, a BS cannot notify MSs that there is no broadcast message transmitted during certain broadcast cycles. Thus, a MS has to periodically monitor the common control channel to receive broadcast messages from a BS. Accordingly, a MS must periodically check the common control channel for at least every 80ms, even when there are no messages transmitted from a BS. This unnecessarily wastes the power consumption of a MS.

SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to solve at least the problems and disadvantages of the related art.

Another object of the present invention is to provide a more efficient method for transmitting

and receiving short broadcast message services in a communication system.

A further object of the present invention is to provide a method for transmitting and receiving short broadcast message services in a communication system which reduce a battery consumption of a mobile station.

5 Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objects and advantages of the invention may be realized and attained as particularly pointed out in the appended claims.

0 To achieve the objects and in accordance with the purposes of the invention, as embodied and broadly described herein, a method for transmitting and receiving short broadcast message services in a communication system comprises transmitting a broadcast indicator to notify whether a base station is transmitting a broadcast message to a mobile station; receiving the broadcast indicator by a mobile station; and receiving the broadcast message transmitted from the base station through a common control channel during a broadcast cycle when the broadcast message is transmitted at a predetermined broadcast cycle from the base station using the received broadcast indicator.

5 In another embodiment of the present invention, a method for transmitting and receiving short broadcast message services in a communication system comprises transmitting, from a base station to a mobile station, a broadcast indicator through an expanded system parameter message to notify whether the base station is transmitting a current broadcast message; determining, at the mobile station, a broadcast indicator value at an arrival time of the broadcast cycle notified by the

base station; periodically checking, at the mobile station, a corresponding common control channel when the current broadcast message will be transmitted; and receiving, at the mobile station, a corresponding broadcast message along with periodically checking the channel transmitted the broadcast message.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be described in detail with reference to the following drawings in which like reference numerals refer to like elements wherein:

Fig. 1 shows a paging channel for a SMS;

Fig. 2 shows a paging channel to explain a periodic broadcast paging method in the related art;

Fig. 3 and 4 show a paging channel for a broadcast message transmitting and receiving method according to the present invention;

Figs. 5 to 7 show a quick paging channel to explain a SMS according to the present invention; and

Fig. 8 shows a partial field of an expanded system parameter message according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Generally, the present invention transmits a broadcast indicator to a mobile station through a quick paging channel (QPCH) to notify

the MS whether a base station is transmitting a broadcast message through a control channel. As in the related art, the control channel may be either a paging channel or a broadcast channel, but for purposes of explanation, the present invention will be discussed with respect to the paging channel.

Fig. 3 shows a paging channel for transmitting and receiving SMS according to the present invention. Also, Fig. 4 is an enlarged diagram of the paging channel of Fig. 3 and Fig. 5 shows a configuration of the QPCH to explain the SMS according to the present invention. Namely, the present invention additionally uses a QPCH_BI_SUPPORTED field in an expanded system parameter message. The QPCH_BI_SUPPORTED field is used to notify whether a BS provides a broadcast indicator to a MS.

Referring to Fig. 3, as in the CDMA mobile communication system in the related art, a BS loads and transmits broadcast message(s) in the 80ms slot intervals of a broadcast cycle. However, in the present invention, a broadcast indicator as well as a paging indicator and a configuration change indicator are also periodically transmitted in an 80ms interval to the MS through the QPCH, before transmitting the broadcast message(s), as shown in Figs. 4 and 5. In the preferred embodiment, the indicators are transmitted 100ms prior to transmitting the broadcast messages.

As in the related art, the broadcast cycle has a period of 2048 where each slot recurs in every 2048 slot of the paging channel with respect to the system time and the slot number SLOT_NUM in which a broadcast message is transmitted can be calculated by Equation 1. Similarly, a value of the maximum slot cycle index MAX_SLOT_CYCLE_INDEX field of the system parameter message is transmitted to the MS through the paging channel from the BS before periodically transmitting the broadcast message(s) and is used to calculate the maximum broadcast cycle M by Equation 2 above.

Accordingly, the BS transmits the broadcast page information through the first slot of the broadcast cycle as calculated by Equation 3 based upon the maximum broadcast cycle M.

Also, the broadcast page information transmitted through the first slot of the broadcast cycle includes at least one broadcast addresses (BC_ADDR), where a BC_ADDR includes information regarding the broadcast message. Thereafter, the BS periodically transmits broadcast messages in subsequent slots corresponding to the broadcast address(es) in the broadcast cycle.

Furthermore, as in the related art, a broadcast index field BCASE_INDEX of an expanded system parameter message is used, where a value of BCASE_INDEX is set as 'i, ($1 \leq i \leq 7$)' when a BS provides a SMS and '0' otherwise. If the value of the BCASE_INDEX using 3 bits is set as 'i,' the broadcast cycle in which the broadcast message is transmitted can be calculated using Equation 4. After the value of B is obtained by Equation 4, a broadcast message can be transmitted by a broadcast cycle of (B+3) and the first slot of a broadcast cycle can be calculated by Equation 5.

According to the present invention, however, a BS may provide a broadcast indicator and a QPCH_BI_SUPPORTED field to MSs to notify that the BS is transmitting broadcast message(s). If a BS provides a broadcast indicator to MSs, the QPCH_BI_SUPPORTED of the expanded system parameter message would be set to a value of "1" to notify an existence of a broadcast indicator, and otherwise to a value of "0". Here, the value of QPCH_BI_SUPPORTED may alternatively be set to "0" to notify the existence of a broadcast indicator and to "0," otherwise.

The broadcast indicator which notifies an existence of a broadcast message is included and transmitted through the QPCH, where the QPCH is transmitted 100ms prior to the transmission of a paging channel slot including a broadcast message. Moreover, the QPCH includes and transmits the paging indicator and a configuration change indicator as well as the broadcast indicator.

Particularly, the broadcast indicator may be inserted and transmitted in a reserved region of the QPCH. A MS then temporarily stores the QPCH_BI_SUPPORTED field value of the expanded system parameter message from the BS in a memory device. If a MS in a non-active state is configured to receive a broadcast message, such MS would periodically monitor the first slot of the paging channel in every broadcast cycle.

However, if the QPCH_BI_SUPPORTED field value of the extended system parameter message is set to '1' and if a MS is configured to receive a broadcast indicator, such MS would check the QPCH transmitted 100ms before each slot of the paging channel in the broadcast cycle to determine the broadcast indicator value. Thus, if the QPCH_BI_SUPPORTED field value is set to "1" and the broadcast indicator is also set to "1," a MS would determine that a broadcast page information and broadcast message(s) is transmitted through the paging channel and would monitor the paging channel to receive the necessary messages.

If the QPCH_BI_SUPPORTED field value is set to "1" while the broadcast indicator is set to "0," a MS would enter into an idle state without monitoring the paging channel.

If the "QPCH_BI_SUPPORTED" field value is set to "0," a MS would periodically monitor the first slot of the paging channel for every broadcast cycle as in the related art, and would receive the broadcast page information from the BS. Furthermore, if several broadcast addresses (BC_ADDR) are included in the broadcast page information, a MS would monitor the subsequent slots to receive the necessary broadcast message.

Fig. 6 shows the QPCH of Fig. 5 when the data rate is 4800bps and Fig. 7 shows the QPCH of Fig. 5 when the data rate is 9600bps. Namely, Figs. 6 and 7 show configurations of the QPCH of Fig. 5 in which 1, 2 or 4 bits are used for transmitting the broadcast indicator. However, using 1

bit for the broadcast indicator requires a high power supply. Therefore, by transmitting the broadcast indicator using at least 2 bits, as shown in Figs. 6 and 7, lowers the power consumption and reduces an interruption factor.

Fig. 8 shows a portion of the expanded system parameter message field which additionally includes the QPCH_BI_SUPPORTED field and the broadcast index field (BCAST_INDEX) of 3 bits according to the present invention.

According to the present transmitting and receiving method of short message broadcast services, the BS notifies to the MS, in advance, whether a transmission of broadcast message currently exists. Therefore, a MS need not unnecessarily and periodically monitor the common control channel (the paging channel or the broadcast channel) to receive a broadcast message from the BS, if there is no broadcast message. Thus, the present invention prevents a waste of power consumption by the MS and increases the efficiency of the short message broadcast services.

The foregoing embodiments are merely exemplary and are not to be construed as limiting the present invention. The present teachings can be readily applied to other types of apparatuses. The description of the present invention is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art.

WHAT IS CLAIMED IS:

1. A method for transmitting and receiving short message broadcast services in a communication system comprising:

5 transmitting a broadcast indicator to notify whether a base station is transmitting a broadcast message to a mobile station;

receiving, at the mobile station, the broadcast indicator and checking a status of the broadcast indicator; and

receiving, at the mobile station, a broadcast message from said base station if the status of the broadcast indicator indicates that said base station is transmitting a broadcast message, wherein said broadcast message is received through a common control channel during a broadcast cycle.

2. A method of claim 1, further comprising transmitting, from said base station to the mobile station, an index through a paging channel prior to transmitting the broadcast indicator, wherein the index is used to calculate the broadcast cycle.

3. A method of claim 1, wherein transmitting the broadcast indicator through a quick paging channel before transmitting a broadcast message.

4. A method of claim 3, wherein inserting and transmitting the broadcast indicator in a reserved region of the quick paging channel.

5. A method of claim 4, wherein the quick paging channel further includes a paging indicator and a configuration change indicator.

6. A method of claim 3, wherein transmitting the broadcast indicator by at least 2 bits.

7. A method of claim 3, wherein transmitting the broadcast indicator 100ms prior to transmitting a broadcast message.

8. A method of claim 3, wherein transmitting a broadcast message through the paging channel.

9. A method of claim 1, further comprising:
adding a field to an expanded system parameter message and transmitting said field to the mobile station, wherein said field notifies whether said base station provides a broadcast indicator;
checking, at the mobile station, the status of the broadcast indicator, if said field indicates that said base station provides a broadcast indicator; and
receiving, at the mobile station, a broadcast message from said base station if the status of the broadcast indicator indicates that said base station is transmitting a broadcast message.

10. A method of claim 9, wherein monitoring, at the mobile station, a first slot of a control channel in every broadcast cycle, if said field indicates that said base station does not provide a broadcast indicator.

11. A method of claim 9, wherein transmitting said field to the mobile station before transmitting a broadcast message to the mobile station.

12. A method of claim 9, wherein temporarily storing said field in a memory device of the mobile station.

13. A method of claim 1, wherein the common control channel is one of either a paging channel or a broadcast channel.

14. A method of claim 1, wherein the mobile station enters an idle state if the broadcast indicator indicates that said base station not is transmitting a broadcast message.

15. A method for transmitting and receiving short message broadcast services in a communication system comprising:

adding a field to an expanded system parameter message and transmitting said field to a mobile station, wherein said field notifies whether a base station provides a broadcast indicator;

transmitting a broadcast indicator through a quick paging channel before transmitting a broadcast message to notify whether the base station is transmitting a broadcast message to a mobile station;

receiving and checking, at the mobile station, the status of the broadcast indicator, if said field indicates that a base station provides a broadcast indicator; and

receiving, at the mobile station, a broadcast message from said base station if the status of the broadcast indicator indicates that said base station is transmitting a broadcast message, wherein said broadcast message is received through a common control channel during a broadcast cycle.

5 16. A method of claim 15, wherein inserting and transmitting the broadcast indicator in a reserved region of the quick paging channel by at least 2 bits.

 17. A method of claim 15, wherein transmitting the broadcast indicator 100ms prior to transmitting a broadcast message.

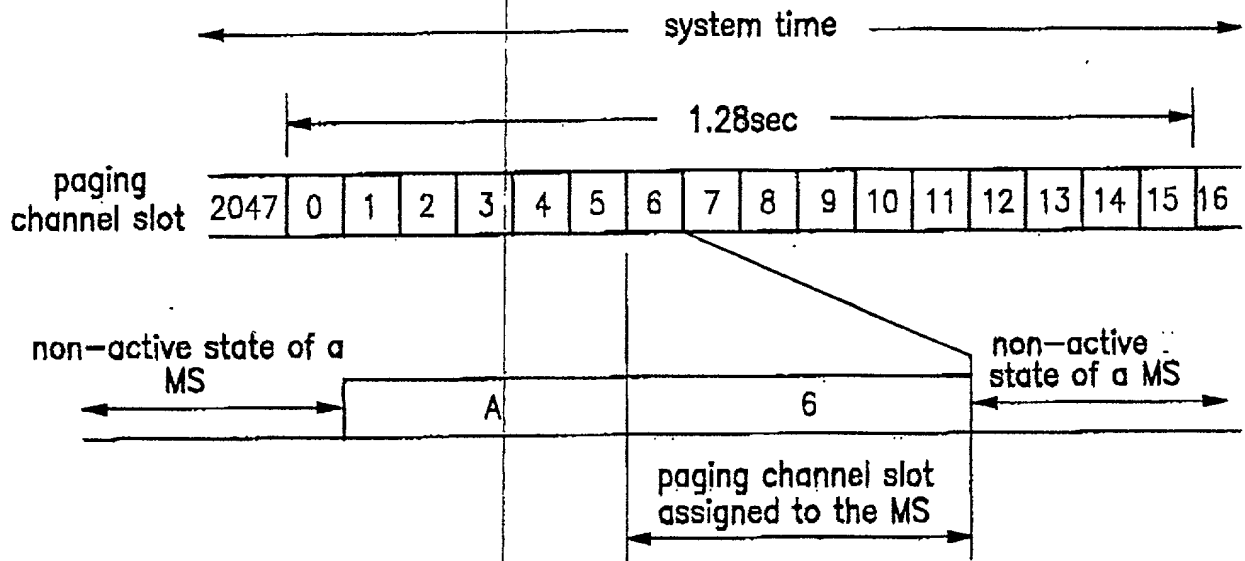
 18. A method of claim 15, wherein monitoring, at the mobile station, a first slot of a control channel in every broadcast cycle, if said field indicates that said base station does not provide a broadcast indicator.

 19. A method of claim 15, wherein the mobile station enters an idle state if the broadcast indicator indicates that said base station not is transmitting a broadcast message.

ABSTRACT

A method for transmitting and receiving short message broadcast services in a communication system is disclosed. The present invention reduces a battery consumption of a mobile station by additionally using an inserted message field of a broadcast indicator for notifying whether a broadcast message is being transmitted from a base station to the MS, thereby allowing a more efficient short message broadcast service.

FIG.1



A:Reacquisition of CDMA system
 B:Mobile station's Assigned paging channel slot

FIG.2

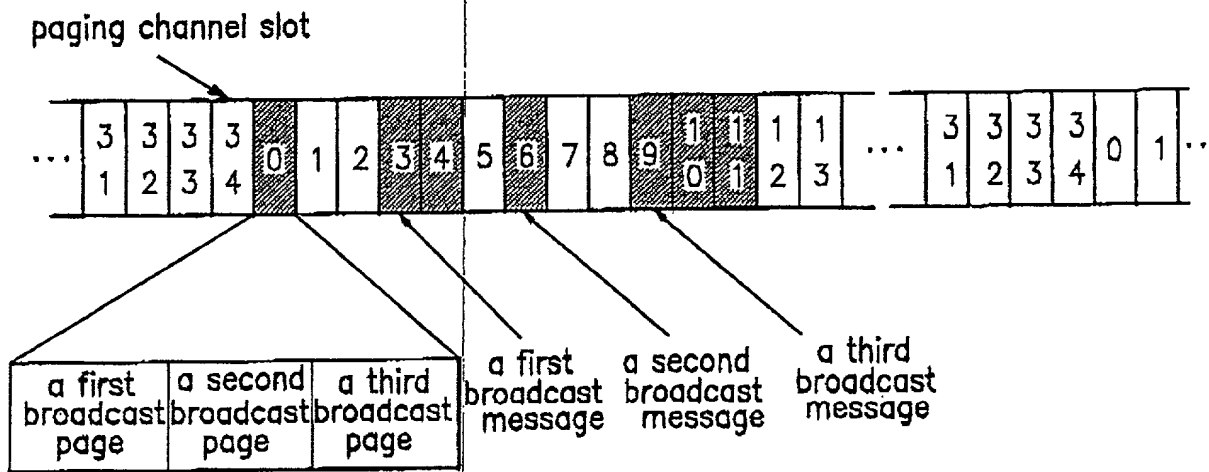


FIG.3

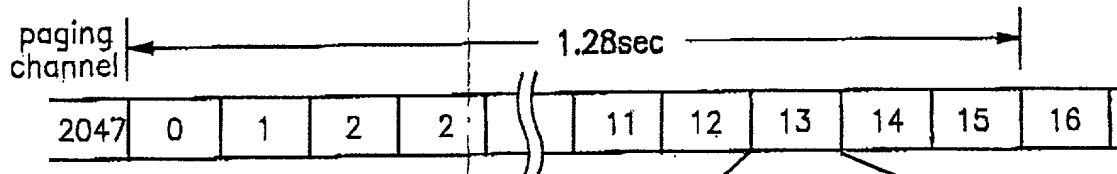


FIG.4



FIG.5

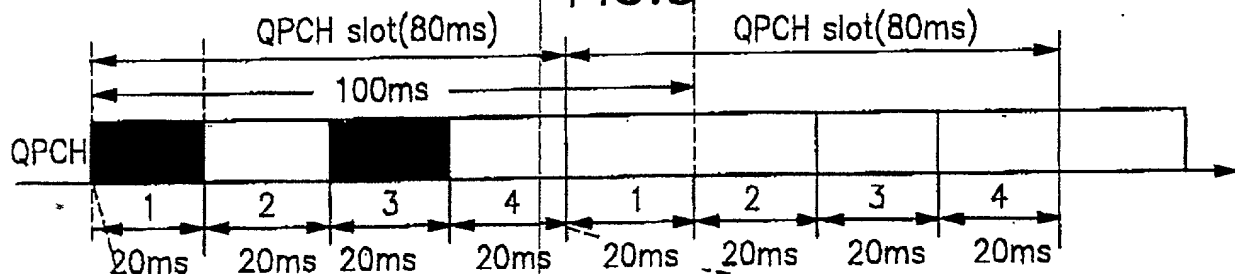
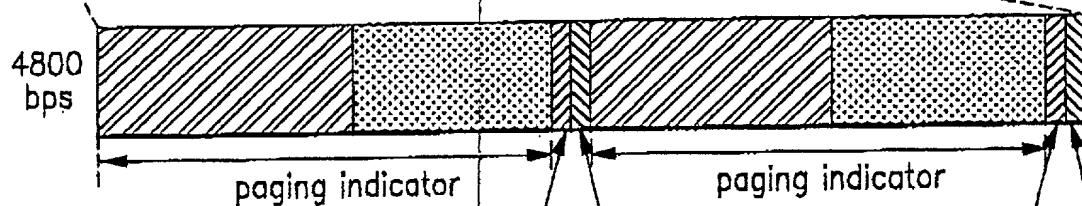


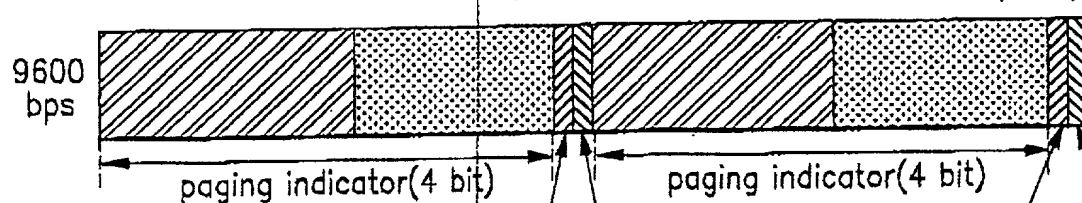
FIG.6



broadcast
indicator(2 bit) configuration
change
indicator(2 bit)

broadcast
indicator(2 bit) configuration
change
indicator(2 bit)

FIG.7



broadcast
indicator(4 bit) configuration
change
indicator(4 bit)

broadcast
indicator(4 bit) configuration
change
indicator(4 bit)

FIG.8

FIELD	LENGTH
TMSI_ZONE	8 TMSI_ZONE_LEN
BCAST_INDEX	3
IMSI_T_SUPPORTED	1

:

QPCH_SUPPORTED	1
NUM_QPCH	0 or 2
QPCH_RACH	0 or 1
QPCH_POWER_LEVEL_PAGE	0 or 3
QPCH_CCI_SUPPORTED	0 or 1
QPCH_BI_SUPPORTED	0 or 1
QPCH_POWER_LEVEL_CONFIG	0 or 2

:

Docket No.:

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter claimed and for which a patent is sought on the invention entitled METHOD FOR TRANSMITTING AND RECEIVING MESSAGE OF SHORT MESSAGE BROADCASTING SERVICES IN TELECOMMUNICATION SYSTEM the specification of which

☒ [X] is attached hereto ☐ [] was filed on _____ as Application Serial No. _____ and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is known to me to be material to patentability in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365 (b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s):

Number

Country

Foreign Filing Date

Month/Day/Year

1999/37479

Korea

September / 3 / 1999

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s):

Filing Date (Month/Day/Year)

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

Prior U. S. Application

or PCT Parent Number

Filing Date (Month/Day/Year)

Parent Patent Number (if applicable)

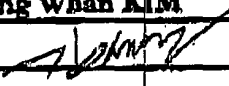
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorney(s) and/or agent(s): Daniel Y.J. Kim, Registration No. 36,186 and Mark L. Freshner, Registration No. 34,596; Carl R. Wesolowski, Registration No. 40,372; John C. Eischenhart, Registration No. 38,128; Rene A. Vazquez, Registration No. 38,647; Michael J. Cornelison, Registration No. 40,395; and Stuart I. Smith, Registration No. 42,159; and Carol L. Drusbick, Registration No. 40,287, all of

FLESHNER & KIM
P. O. Box 221200
Chantilly, Virginia 20153-1200

with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and all future correspondence should be addressed to them.

Full name of sole or first inventor: **Seong Whan KIM**

Inventor's signature: 

Date: **Sept 1, 2000**

Residence: **Kyonggi-do, Korea**

Citizenship: **Republic of Korea**

Post Office Address: **Hogye Jookong 204-305, Hogye-dong, Tongan-gu, Anyang-shi,
Kyonggi-do, Korea**

Full name of joint inventor(s): **Cheol Kyun HEO**

Inventor's signature: 

Date: **SEP. 1, 2000**

Residence: **Kyonggi-do, Korea**

Citizenship: **Republic of Korea**

Post Office Address: **201, 919-11, Hogye2-dong, Tongan-gu, Anyang-shi,
Kyonggi-do, Korea**

Full name of joint inventor(s):

Inventor's signature:

Date:

Residence:

Citizenship:

Post Office Address:

Full name of joint inventor(s):

Inventor's signature:

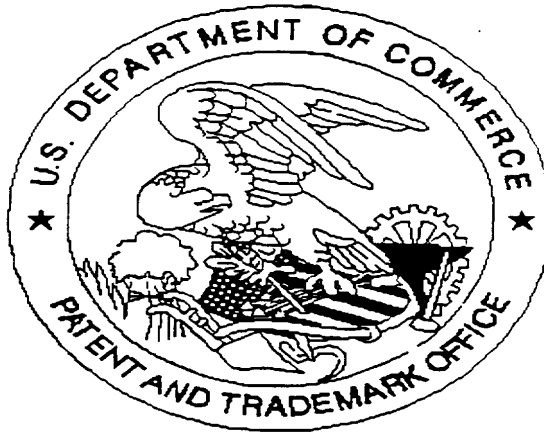
Date:

Residence:

Citizenship:

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